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Williams (8) reported that more exercise by walking or running correlated with lower pneumonia mortality over an 11-year follow-up period. However, death due to pneumonia, “the old man's friend”, strongly associates with old-age frailty and underlying disease (4). Less healthy participants in Williams' study may have been walking and running less at baseline. Thus, poorer baseline health could be the primary explanation for pneumonia deaths occurring many years later. Williams adjusted the Cox models for age, sex, education, smoking, and meat, fruit and alcohol intake (8). However, the correlations between various lifestyle variables are extensive, as demonstrated by, for example, Smith et al. (7). Thus, when comparing people by their self-selected exercise levels, adjusting for half a dozen confounders cannot capture all the relevant baseline differences in health status and lifestyle. Residual confounding may therefore explain the reported correlations (8).

As noted above, pneumonia mortality is a poor outcome for assessing the health effects of lifestyle. Pneumonia incidence is a much more relevant outcome, since it associates less with old-age frailty and underlying disease. In our cohort study of 16,804 middle-aged men, we found no difference in pneumonia incidence between those who had physically most demanding jobs (adjusted RR = 0.98; 95% CI 0.46-2.04) and those who had physically least demanding jobs (3). In addition, participants who engaged in moderate physical activity during their leisure time did not show a lower pneumonia incidence than did sedentary participants (adjusted RR = 1.51; 95% CI 0.90-2.53). This lack of association is inconsistent with any substantial effects of moderate physical activity against pneumonia incidence. These problems in residual confounding and outcome validity call into question the dose response suggested by Williams (8).

Furthermore, heavy physical activity increases oxidative stress (6), so that extreme exertion could harm the immune system. For example, Navy and Marine recruits had a 30-fold higher rate of hospital admission for pneumonia than did non-recruits (5), and Navy and Marine personnel with <1 year of service were at a 5-fold higher risk for pneumonia than were their peers with ³⁴ years of service (1). Heavy exertion is a characteristic feature of recruit training and could explain the elevated pneumonia incidence among the studied young and healthy adults. Williams (8) failed to consider these findings indicating that heavy physical stress can increase pneumonia risk.

Finally, since demanding physical activity increases oxidative stress (6), antioxidants could affect certain physically active people. We found that vitamin E halved the risk for pneumonia in middle-aged men who exercised during their leisure time, but had no effect on those who engaged in demanding job activity (2,3). This divergence based on the type of physical activity can be attributed to adaptation, since regular work activity leads to adaptation whereas sporadic leisure-time activity does not (6). The effectiveness of antioxidant vitamin E in this randomized trial setting

indirectly supports a relationship between leisure-time physical activity and susceptibility to pneumonia (2,3), even though no dose-response relationship can be inferred between physical activity level and risk for pneumonia.

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